

Factors that Lengthen Patient Hospitalizations Following Laparoscopic Hysterectomy

Laura Ramirez-Caban, MD, Akshaya Kannan, MD, MPP, Emily R. Goggins, MD, MPH, Marie E. Shockley, MD, Lisa B. Haddad, MD, MS, MPH, E. Britton Chahine, MD

ABSTRACT

Objective: To establish descriptive observations associated with prolonged hospitalization after laparoscopic hysterectomy prior to the implementation of a department-wide Enhanced Recovery After Surgery protocol.

Methods: A retrospective cohort study at three academic affiliated hospitals in the southeastern United States was conducted evaluating length of hospitalization by patient, surgical, and physician factors for 384 patients who underwent total laparoscopic hysterectomy, laparoscopic assisted vaginal hysterectomy, and robotic assisted total laparoscopic hysterectomy for benign conditions by general and subspecialized gynecologists from 2010 to 2015.

Results: Among 384 patients, 19.5% experienced prolonged hospitalization, defined as greater than one day. After adjusting for covariates, robotic assisted total laparoscopic hysterectomy (aOR 3.13), dietary restrictions on postoperative day 1 (aOR 4.42), postoperative nausea or vomiting (aOR 2.01), and postoperative complications (aOR 3.58) were associated with prolonged hospitalization.

Conclusion: Data from this study were collected prior to implementation of department-wide enhanced recovery after surgery protocols and highlights areas for improvement. Implementation of specific aspects of these protocols, including aggressive prevention of postoperative nausea and vomiting and early feeding, are easily made changes which may help to effectively decrease length of

stay after laparoscopic hysterectomy. Patient and provider education on enhanced recovery protocols is also key to reducing length of stay.

Keywords: Laparoscopy, Length of stay, Hysterectomy, Prolonged hospitalization.

INTRODUCTION

In an increasingly expensive healthcare system, inpatient hospitalizations account for one-third of costs.¹ Despite pressure to reduce expenses through shorter inpatient stays, patients undergoing surgical procedures often remain hospitalized longer than projected due to comorbidities, postoperative complications, or physician factors such as preference and experience.²⁻⁴

Implementation of the Enhanced Recovery After Surgery (ERAS) protocol in gynecologic surgery has yielded significant reductions in length of hospitalization and associated costs.^{2,5-10} The new accepted standard among gynecologic surgeons is to allow for discharge in the same day or in less than 23 hours following laparoscopic hysterectomy.^{6,11} However, nationwide implementation of ERAS protocols, including at our institution, have not been established, and the incidence and specific predictors of prolonged hospitalization at our institution are not known. Though the causes for prolonged hospitalization are multifactorial, identifying potentially modifiable factors is an important step toward making change. The goal of this study was to establish descriptive observations associated with prolonged hospitalization after laparoscopic hysterectomy prior to the implementation of a department-wide ERAS protocol. The results of this preliminary study will allow physicians to prioritize postoperative care practices that decrease length of hospitalization and healthcare costs, and will allow for outcome comparison following ERAS protocol implementation.

MATERIALS AND METHODS

We conducted a retrospective cohort study in the Emory University Healthcare System of all laparoscopic hysterectomies performed from 2010 to 2015. The Current Proce-

Emory University Health System, Atlanta, GA, USA (all authors).

Disclosures: none.

Funding/Financial Support: none.

Conflicts of Interest: The authors have no conflicts of interest directly relevant to the content of this article.

Informed consent: Dr. Ramirez-Caban declares that written informed consent was obtained from the patient/s for publication of this study/report and any accompanying images.

Address correspondence to: Laura Ramirez-Caban, MD, 2950 Cleveland Clinic Blvd., Weston, FL, USA 33331. Tel: +610-507-9061, E-mail: lramirezcaban@gmail.com.

DOI: 10.4293/JSLS.2020.00029

© 2020 by JSLS, *Journal of the Society of Laparoscopic & Robotic Surgeons*. Published by the Society of Laparoendoscopic & Robotic Surgeons, Inc.

dural Terminology coding system was used to identify all laparoscopic hysterectomies performed during the study period (January 1, 2010 to December 31, 2015). Patients who underwent total laparoscopic hysterectomy (TLH), laparoscopic assisted vaginal hysterectomy (LAVH), and robotic assisted total laparoscopic hysterectomy (RA-TLH) and were between the ages of 18 and 75 years at the time of surgery were included in the study. Exclusion criteria included prior renal or liver disease, history of chronic opiate use, true allergy or contraindication to nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, and/or opioids, use of continuous anesthetic infusion device, a prior diagnosis of pelvic malignancy, vaginal hysterectomy, conversion to open hysterectomy, prior diagnosis of chronic pelvic or back pain, prior diagnosis of fibromyalgia, incomplete or inaccurate medical record documentation, and additional surgeries performed at the time of hysterectomy. Incomplete medical record documentation was defined as a missing patient facesheet, anesthesia record, operative report, inpatient progress notes, or discharge summary. Inaccurate records refer to those that listed a laparoscopic or laparoscopic assisted hysterectomy as the procedure type but, upon review of the full operative report, were actually performed vaginally or abdominally. For cases that met our inclusion criteria, the electronic medical record was reviewed, and study data was abstracted and managed using Research Electronic Data Capture by trained medical students and clinicians using a standardized code book.

Our primary outcome was prolonged hospitalization. Length of hospitalization was determined by overnight admission with midnight delineating hospital day numbers. Prolonged hospitalization was defined as hospital stay of greater than one day.

Primary exposures of interest included patient, surgical, postoperative, and physician factors. Patient factors included age, race/ethnicity, body mass index (BMI), history of diabetes mellitus or hypertension, American Society of Anesthesiology score, and tobacco use within the last year. Surgical factors included hysterectomy approach, length of surgery, uterine size, blood loss, hospital location, and intraoperative complications including urologic or bowel injury, and need for blood transfusion. Postoperative factors included intravenous (IV) and oral narcotic administration within 24 hours of surgery, NSAID administration, diet regimen on postoperative day 1, postoperative nausea or vomiting, and postoperative complications including need for blood transfusion, acute kidney injury requiring dialysis, and other.

Physician factors included physician length of practice, completion of advanced surgical training, and surgical volume. Physician information was obtained using multiple resources. Professional and networking websites were used to identify physicians with advanced surgical training (non-AAGL pelvic surgery training, female pelvic medicine and reconstructive surgery, or gynecology oncology) and year of residency training completion. Physician practice length was determined by comparing the date of surgery to physician residency graduation year. In our study, physician practice length was stratified by less than 10 years and greater than or equal to 10 years. Surgical volume was determined by averaging surgical caseload over the number of years the physician operated within the Emory system. We assigned high surgical volume as greater than or equal to 10 hysterectomies performed per year based on previously published studies utilizing this value.¹²⁻¹⁴

We used logistic regression to analyze patient, surgical, postoperative, and physician factors associated with prolonged hospitalization after laparoscopic hysterectomy. Variables that were significant in bivariate analyses at an α less than 0.1 were entered into an adjusted multivariate model and retained regardless of significance. The final model was examined for multicollinearity using a variance inflation factor cut-off of 10. Unadjusted and adjusted odds ratios and 95% confidence intervals were generated. An α of 0.05 was employed for all tests of significance. All

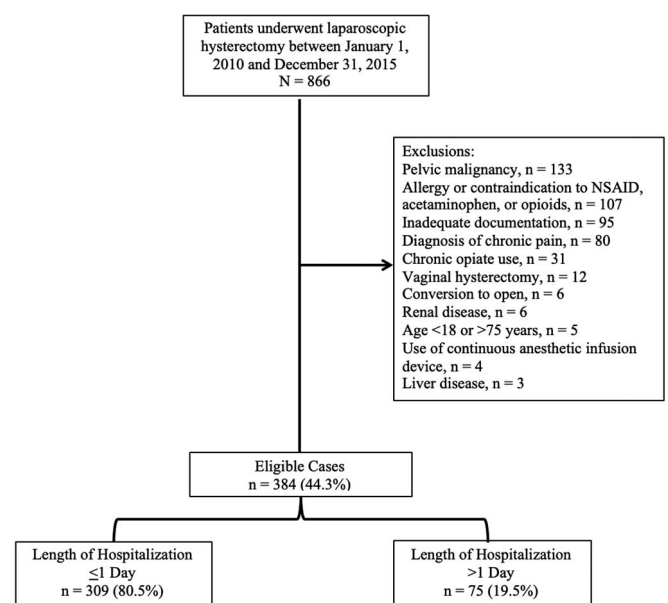


Figure 1. Inclusion of study participants and distribution of primary outcome.

Table 1.
Patient, Surgical, Postoperative, and Physician Factors by Length of Hospitalization

	Total Study Population n = 384 n (%)	Length of Hospitalization <1 Day n = 309 (80.5%) n (%)	Length of Hospitalization >1 Day n = 75 (19.5%) n (%)
Patient Factors			
Age, y			
18–45	176 (45.8)	139 (45.0)	37 (49.3)
45–55	149 (38.8)	125 (40.5)	24 (32.0)
56–75	59 (15.4)	45 (14.6)	14 (18.7)
Race/Ethnicity			
Non-Hispanic White	68 (17.7)	55 (17.8)	13 (17.3)
Non-Hispanic Black	197 (51.3)	165 (53.4)	32 (42.7)
Non-Hispanic Other	6 (1.6)	5 (1.6)	1 (1.3)
Hispanic	10 (2.6)	8 (2.6)	2 (2.7)
Unknown	103 (26.8)	76 (24.6)	27 (36.0)
BMI, kg/m ²			
<30	201 (52.3)	165 (53.4)	36 (48.0)
30–40	139 (36.2)	111 (35.9)	28 (37.3)
>40	35 (9.1)	28 (9.1)	7 (9.3)
Unknown	9 (2.3)	5 (1.6)	4 (5.3)
History of diabetes or hypertension			
No	233 (60.7)	189 (61.2)	44 (58.7)
Yes	151 (39.3)	120 (38.8)	31 (41.3)
ASA score			
<3	303 (78.9)	241 (78.0)	62 (82.7)
>3	77 (20.1)	64 (20.7)	13 (17.3)
Unknown	4 (1.0)	4 (1.3)	0 (0)
Tobacco use in last year			
No	339 (88.3)	269 (87.1)	70 (93.3)
Yes	28 (7.3)	25 (8.1)	3 (4.0)
Unknown	17 (4.4)	15 (4.9)	2 (2.7)
Surgical Factors			
Hysterectomy approach			
TLH	55 (14.3)	50 (16.2)	5 (6.7)
LAVH	97 (25.3)	78 (25.2)	19 (25.3)
RA-TLH	232 (60.4)	181 (58.6)	51 (68.0)
Length of surgery			
<3 h	210 (54.7)	171 (55.3)	39 (52.0)
>3 h	174 (45.3)	138 (44.7)	36 (48.0)
Uterine size			
<250 g	267 (69.5)	216 (69.9)	51 (68.9)
>250 g	94 (24.5)	75 (24.3)	19 (25.3)
Unknown	23 (6.0)	18 (5.8)	5 (6.7)
Intraoperative complications			
No	369 (96.1)	301 (97.4)	68 (90.7)
Yes	15 (3.9)	2 (2.6)	7 (9.3)

Table 1.
Continued

	Total Study Population n = 384 n (%)	Length of Hospitalization <1 Day n = 309 (80.5%) n (%)	Length of Hospitalization >1 Day n = 75 (19.5%) n (%)
Blood loss			
<250 ml	286 (74.5)	231 (74.8)	55 (73.3)
>250 ml	98 (25.5)	78 (25.2)	20 (26.7)
Hospital Location			
Hospital 1	255 (66.4)	197 (63.8)	58 (77.3)
Hospital 2	81 (21.1)	66 (21.4)	15 (20.0)
Hospital 3	48 (12.5)	46 (14.9)	2 (2.7)
Postoperative Factors			
IV narcotic ordered			
No	278 (72.4)	217 (70.2)	61 (81.3)
Yes	103 (26.8)	92 (29.8)	11 (14.7)
Unknown	3 (0.8)	0 (0)	3 (4.0)
PO narcotic ordered			
No	118 (30.7)	91 (29.5)	27 (36.0)
Yes	263 (68.5)	218 (70.6)	45 (60.0)
Unknown	3 (0.8)	0 (0)	3 (4.0)
NSAID ordered within 4 h			
No	38 (9.9)	32 (10.4)	6 (8.0)
Yes	344 (89.6)	277 (89.6)	67 (89.3)
Unknown	2 (0.5)	0 (0)	2 (2.7)
NSAID received			
No	99 (25.9)	84 (27.2)	15 (20.0)
Yes	283 (73.7)	225 (72.8)	58 (77.3)
Unknown	2 (0.5)	0 (0)	2 (2.7)
Regular diet by postoperative day 1			
No	60 (15.6)	32 (10.4)	28 (37.3)
Yes	210 (54.7)	180 (58.3)	30 (40.0)
Unknown	114 (29.7)	97 (31.4)	17 (22.7)
Postoperative nausea or vomiting >4 h			
No	215 (56.0)	177 (57.3)	38 (50.7)
Yes	80 (20.8)	54 (17.5)	26 (34.7)
Unknown	89 (23.2)	78 (25.2)	11 (14.7)
Postoperative complications			
No	325 (84.6)	271 (87.7)	54 (72.0)
Yes	49 (12.8)	28 (9.1)	21 (28.0)
Unknown	10 (2.6)	10 (3.2)	0 (0)
Physician Factors			
Physician practice length			
<10 y	119 (31.0)	98 (31.7)	21 (28.0)
>10 y	265 (69.0)	211 (68.3)	54 (72.0)
Advanced surgical training			
No	244 (63.5)	191 (61.8)	53 (70.7)
Yes	140 (36.5)	118 (38.2)	22 (29.3)

Table 1.
Continued

	Total Study Population n = 384 n (%)	Length of Hospitalization <1 Day n = 309 (80.5%) n (%)	Length of Hospitalization >1 Day n = 75 (19.5%) n (%)
Surgical volume			
<10 cases/y	152 (39.6)	121 (39.2)	31 (41.3)
>10 cases/y	232 (60.4)	188 (60.8)	44 (58.7)

BMI, body mass index; ASA, American Society of Anesthesiology; TLH, total laparoscopic hysterectomy; LAVH, laparoscopic assisted vaginal hysterectomy; RA-TLH, robotic assisted total laparoscopic hysterectomy; IV, intravenous; O, Oral; NSAID, nonsteroidal anti-inflammatory drug.

analyses were conducted using SAS Software version 9.4 (SAS Institute Inc., Cary, NC, USA).

Expedited approval from the Emory University Institutional Review Board was obtained for this study. No formal written consent was required from the study participants given the retrospective nature of the study and data collection.

RESULTS

We identified 866 patients who underwent laparoscopic hysterectomy during the study period. After exclusions, 384 patients were included in the analysis. Among these 384 patients, 75 (19.5%) experienced a prolonged hospitalization (**Figure 1**). (**Table 1**) shows the baseline patient, surgical, postoperative, and physician factors by length of hospitalization.

In bivariate analyses, surgical factors associated with prolonged hospitalization included RA-TLH and intraoperative complications. Postoperative factors associated with prolonged hospitalization included IV narcotic administration, dietary restrictions on postoperative day 1, postoperative nausea or vomiting occurring greater than 4 hours after surgery, and postoperative complications. Surgery performed at hospital 3 was associated with decreased odds of prolonged hospitalization.

In multivariate analysis, dietary restrictions on postoperative day 1 (aOR 4.42, $p < 0.001$), postoperative nausea or vomiting occurring greater than 4 hours after surgery (aOR 2.01, $p = .04$), and postoperative complications (aOR 3.58, $p < 0.001$) were associated with prolonged hospitalization in the adjusted model (**Table 2**). Postoperative complications occurred in 25 of 75 cases with prolonged hospitalization and included postoperative fever, anemia, blood transfusion, ileus, and cardiopulmonary conditions.

Hysterectomy approach also remained significant with those undergoing RA-TLH having a three-fold increased odds of prolonged hospitalization (aOR 3.13, $p = .03$). Surgery performed at hospital 3 was associated with a 90% reduction in the odds of prolonged hospitalization after adjusting for all other factors considered in the model (aOR 0.10, $p = .03$). Intraoperative complications and IV narcotic use were not significant in the fully adjusted model.

(**Figure 2**) shows the percentage of patients staying greater than one day after laparoscopic hysterectomy by physician. For the majority (71.4%) of physicians, greater than 75% of patients were discharged within 23 hours. For five physicians, greater than 75% of their patients stayed longer than one day, and 80% of these were low volume surgeons.

DISCUSSION

Approximately one-fifth of the patients in our study experienced prolonged length of hospitalization. We identified multiple factors associated with prolonged hospitalization: postoperative nausea or vomiting, dietary restrictions on postoperative day 1, postoperative complications, and RA-TLH. Individual physicians were also noted to be consistently associated with prolonged length of hospitalization.

Patient factors such as age, comorbidities, and BMI were not found to be associated with prolonged hospitalization. O’Hanlan et al.’s study of 830 cases of TLH found similar results.¹⁸ Specifically, age, BMI, parity, and uterine size were not associated with a prolonged stay. In another study of 800 cases which defined prolonged length of stay as greater than two days postoperatively, age greater than 54 years was an independent predictor of increased length

Table 2.
Multivariate Effects of Patient, Surgical, Postoperative, and Physician Factors on Length of Hospitalization

	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	<i>p</i> value
Surgical Factors			
Hysterectomy approach			
TLH	Ref	Ref	.29
LAVH	2.44 (0.86, 6.94)	1.83 (0.59, 5.69)	.03
RA-TLH	2.82 (1.07, 7.43)*	3.13 (1.10, 8.94)*	
Intraoperative complications			
No	Ref	Ref	.06
Yes	3.87 (1.36, 11.05)*	3.25 (0.92, 11.42)	
Hospital location			
Hospital 1	Ref	Ref	.75
Hospital 2	0.77 (0.41, 1.45)	0.89 (0.42, 1.86)	.03
Hospital 3	0.15 (0.04, 0.63)*	0.10 (0.01, 0.84)*	
Postoperative Factors			
IV narcotic ordered			
No	Ref	Ref	.06
Yes	2.35 (1.18, 4.67)*	2.04 (0.95, 4.39)	—
Unknown	—	—	
Regular diet by postoperative day 1			
No	5.25 (2.78, 9.93)*	4.42 (2.21, 8.81)*	< 0.001
Yes	Ref	Ref	0.50
Unknown	1.05 (0.55, 2.00)	1.33 (0.57, 3.12)	
Postoperative nausea or vomiting >4 h			
No	Ref	Ref	.04
Yes	2.24 (1.25, 4.02)*	2.01 (1.02, 3.93)*	.67
Unknown	0.66 (0.32, 1.35)	1.25 (0.45, 3.44)	
Postoperative complications			
No	Ref	Ref	.001
Yes	3.76 (1.99, 7.12)*	3.58 (1.73, 7.41)*	—
Unknown	—	—	

OR, odds ratio; CI, confidence interval; TLH, total laparoscopic hysterectomy; LAVH, laparoscopic assisted vaginal hysterectomy; RA-TLH, robotic assisted total laparoscopic hysterectomy; IV, intravenous.

of stay.³ Differences in our findings may be due to different clinical settings, and our smaller sample size may have reduced our power to detect true differences in our study outcome according to patient factors.

The only surgical factor associated with prolonged hospitalization was hysterectomy approach, namely the robotic surgical approach. This finding diverges from the literature which states that robotic hysterectomy is not associated with increased length of stay compared to laparoscopic hysterectomy.^{15–16} The use of robotics was relatively new at our institution during this study, and our results may reflect unmeasured confounders including

case complexity influencing physician choice for robotic approach, provider robotic experience, and relatively low volume by robotic surgeons. We found that surgery performed at hospital 3, which accounted for the least number of providers, was associated with a decreased risk of prolonged hospitalization. This finding may be attributed to less data sourcing from hospital 3 as compared to other hospitals.

With regard to postoperative factors, we found that postoperative nausea or vomiting, dietary restrictions on postoperative day 1, and postoperative complications were associated with prolonged hospitalization. Postoperative

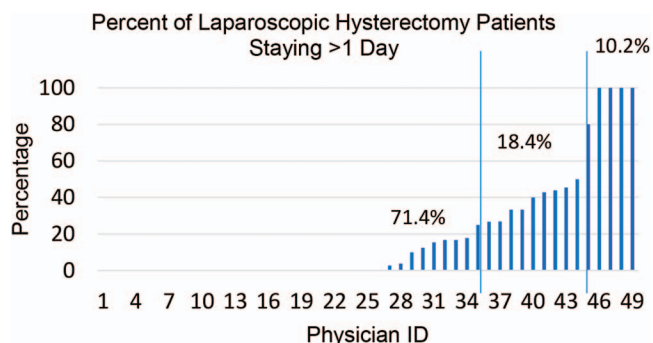


Figure 2. Percent of hysterectomy patients staying greater than 1 day by physician.

complications identified in our study included postoperative fever, anemia and blood transfusion, postoperative ileus, and new cardiopulmonary conditions. These findings are consistent with prior literature.^{3,17–18} While some postoperative factors may not be modifiable, targeting perioperative interventions to minimize nausea or emesis, and to promote intake of a regular diet, may decrease the incidence of prolonged stay.

Initially we found an association between postoperative IV narcotic use and prolonged stay in bivariate analysis. This was not sustained in multivariate analysis; however, the point estimate for IV narcotic use in the adjusted model was large and we may have been underpowered to detect a significant difference. Previous research supports the minimization of IV opioid use postoperatively.¹⁹ NSAIDs were not prescribed in 10.4% of patients within 4 h after surgery. This reflects a lack of uniform practice in ordering medications among providers at our institutions. Additionally, individual training, diversity of training, and attitudes towards postoperative NSAID use may contribute to this result. These findings provide additional support that, despite changing practice guidelines, physician education and unified adaption of best practices may aid in decreasing hospitalization length and improving overall patient outcomes.

Finally, the individual operating physician, independent of surgical volume, length of practice, or completion of advanced surgical training, may be associated with prolonged length of stay after laparoscopic hysterectomy. This finding could reflect physician preference and experience, lack of physician knowledge of ERAS concepts, or timing of publication of ERAS literature relative to collection of study data. More research is needed to evaluate physician knowledge, attitudes, and adaption of implemented enhanced recovery protocols.

Strengths of this study include detailed information on patient, surgical, and postoperative factors obtained via medical record review as well as exclusion of individuals with prior chronic pain conditions, a diagnosis of malignancy, or dependence on narcotics that could confound our interpretation. Limitations of this study include the relatively small sample size. Moreover, while we did include three hospitals in our study, there may be limited generalizability as this study was done within the Emory Healthcare system which is an academic tertiary care center, and the majority of patients included in the study were non-Hispanic Black.

As a consequence of this research, we have made the following recommendations. Within the Emory Healthcare system, education regarding ERAS and implementation of a department-wide protocol should be performed and is currently underway. After implementation of this protocol, ongoing evaluation should occur.²⁰ A decreasing incidence of prolonged hospitalization would support ERAS effectiveness.²¹ Nationally, this study could expand to include other hospital systems where enhanced recovery protocols have not yet been implemented to determine if similar outcomes regarding length of hospitalization are found.

CONCLUSION

We found that surgical and postoperative factors are associated with prolonged hospitalization within our hospital system. Additionally, specific physicians seem to be associated with prolonged hospitalizations independent of length of practice, surgical volume, and advanced surgical training. Despite existing supporting evidence, further education of physicians and adherence to enhanced recovery protocols is key to decreasing length of hospitalization, improving patient outcomes, and decreasing overall healthcare costs. As our health system moves to ERAS implementation, this study has allowed us to identify areas that should be targeted for change by our new protocols.

References:

1. McDermott KW, Elixhauser A, Sun R. Trends in hospital inpatient stays in the United States, 2005–2014. *HCUP Statistical Brief #225*. June 2017. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/reports/statbriefs/sb225-Inpatient-US-StaysTrends.pdf.
2. Kalogera E, Dowdy SC. Enhanced recovery pathway in gynecologic surgery: improving outcomes through evidence-based medicine. *Obstet Gynecol Clin North Am*. 2016;43(3):551–73.

3. Zand B, Frumovitz M, Jofre MF, et al. Risk factors for prolonged hospitalization after gynecologic laparoscopic surgery. *Gynecol Oncol*. 2012;126(3): 428–431.
4. Gibbison B, Kinsella SM. Postoperative analgesia for gynecological laparoscopy. *Saudi J Anaesth*. 2009;3(2):70–76.
5. Kalogera E, Bakkum-Gamez JN, Jankowski CJ, et al. Enhanced recovery in gynecologic surgery. *Obstet Gynecol*. 2013;122(2 Pt 1):319–328.
6. Nikodemski T, Biskup A, Taszarek A, et al. Implementation of an enhanced recovery after surgery (ERAS) protocol in a gynaecology department - the follow-up at 1 year. *Contemp Oncol (Pozn)*. 2017;21(3):240–243.
7. Trowbridge ER, Dreisbach CN, Sarosiek, BM, et al. Review of enhanced recovery programs in benign gynecologic surgery. *Int Urogynecol J*. 2018; 29(1):3–11.
8. Chapman JS, Roddy E, Ueda S, et al. Enhanced recovery pathways for improving outcomes after minimally invasive gynecologic oncology surgery. *Obstet Gynecol*. 2016;128(1): 138–44.
9. Scheib SA, Thomasee M, Kenner JL. Enhanced recovery after surgery in gynecology: a review of the literature. *J Minim Invasive Gynecol*. 2019;26(2):327–343.
10. Trowbridge ER, Evans SL, Sarosiek BM, et al. Enhanced recovery program for minimally invasive and vaginal urogynecologic surgery. *Int Urogynecol J*. 2019 Feb; 30(2):313–321.
11. Nezhat C, Main J, Paka C, et al. Advanced gynecologic laparoscopy in a fast-track ambulatory surgery center. *JSLS*. 2014; 18(3):e2014.00291.
12. Quan-Tran A, Greene N, Cass I. The impact of annual surgical volume on patient outcomes in laparoscopic hysterectomy. *J. Gynecol. Surg*. 2018;34(4).
13. Doll KM, Milad MP, Gossett DR. Surgeon volume and outcomes in Benign Hysterectomy. *J Minim Invasive Gynecol*. 2013;20:554–561.
14. Vree FE, Cohen SL, Chavan N, Einarsson JI. The impact of surgeon volume on perioperative outcomes in hysterectomy. *JSLS*. 2014;18(2):174–181.
15. Albright BB, Witte T, Tofte AN, et al. Robotic versus laparoscopic hysterectomy for benign disease: a systematic review and meta-analysis of randomized trials. *J Minim Invasive Gynecol*. 2016;23(1):18–27.
16. Wright JD, Ananth CV, Lewin SN, et al. Robotically assisted vs laparoscopic hysterectomy among women with benign gynecologic disease. *JAMA*. 2013;309(7):689–698.
17. Miralpeix E, Nick AM, Meyer LA, et al. A call for new standard of care in perioperative gynecologic oncology practice: impact of enhanced recovery after surgery (ERAS) programs. *Gynecol Oncol*. 2016;141(2):371–378.
18. O'Hanlan KA, Dibble SL, Garnier AC, Reuland ML. Total laparoscopic hysterectomy: technique and complications of 830 cases. *JSLS*. 2007;11(1):45–53.
19. Wong M, Morris S, Wang K, Simpson K. Managing postoperative pain after minimally invasive gynecologic surgery in the era of the opioid epidemic. *J Minim Invasive Gynecol*. 2017; 25(7):1165–1178.
20. Gramlich LM, Sheppard CE, Wasylak T, et al. Implementation of enhanced recovery after surgery: a strategy to transform surgical care across a health system. *Implementation Sci*. 2017; 12:67.
21. Lemini R, Spaulding A, Naessens J, et al. ERAS protocol validation in a propensity-matched cohort of patients undergoing colorectal surgery. *Int J. Colorectal Dis*. 2018;33.